KEY

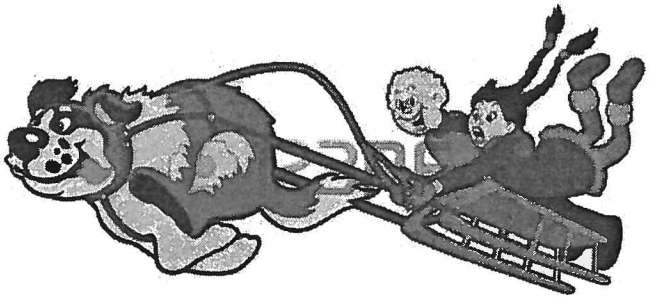
First Name:_____ Last Name:_____

## LO1 – Worksheet – Work and Energy /14 marks

### Part 1: Work in 1-Dimension

*Use the following information to answer Q1 – Q3:*

Fluffy the dog is being used to pull a sled full of children across the snow. Jack weighs 50kg, Jill weighs 45kg, and the sled weighs 2kg. Fluffy is applying a force of 200N.



**Q1:** What energy conversion is being depicted above?

a. Chemical potential energy to kinetic energy.
b. Chemical potential energy to thermal energy.
c. Thermal energy to chemical potential energy.
d. Thermal energy to kinetic energy.

**Q2:** If Fluffy pulls the sled for a total distance of 50m, how much work has Fluffy done?

$W = Fd$
$= (200\,N)(50\,m)$
$= 10{,}000\,J$

**Q3:** The next day, a tired Fluffy tries to pull the sled again. This time she does 2500J of work before giving up and taking a nap. How far did Fluffy pull the sled?

$W = Fd$
$2500 = (200)d$
$d = 12.5\,m$

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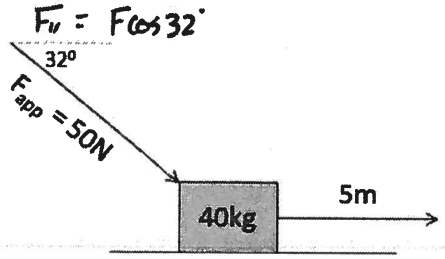
## Part 2: Work in 2-Dimensions

*Use the following information to answer Q4:*

**Force Acting on an Object**



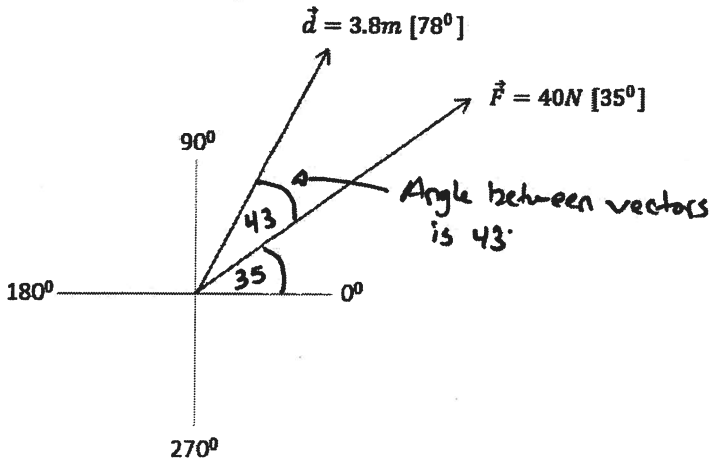

**Q4:** How much work is being done by the force?

$W = F_{\parallel} \cdot d$
$= (50 \cos 32)(5)$
$= 212.012\ J$

a. 132 J
b. 156 J
(c.) 212 J
d. 250 J

*Use the following information to answer Q5:*

**Force and Distance Vectors**




**Q5:** How much work is being done by the force?

$W = |\vec{F}||\vec{d}|\cos\theta$
$= (40)(3.8)\cos 43^\circ$
$= 152\cos 43$
$= 111.2\ J$

a. 31.60 J
b. 103.7 J
(c.) 111.2 J
d. 124.5 J

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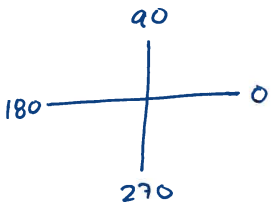
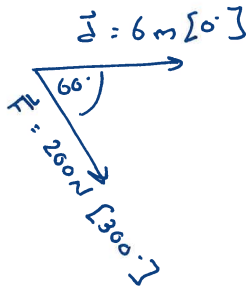
**Q6:** A force of 200N [300$^0$] is acting on an object over a distance of 6m [0$^0$]. The work done on the object is ***a.bc*** x 10$^d$ J, where ***a, b, c,*** and ***d*** are ___, ___, ___, and ___.

*(Record your **four-digit** answer in the Numerical Response boxes below)*

| | | | |
|---|---|---|---|
| 6 | 0 | 0 | 2 |

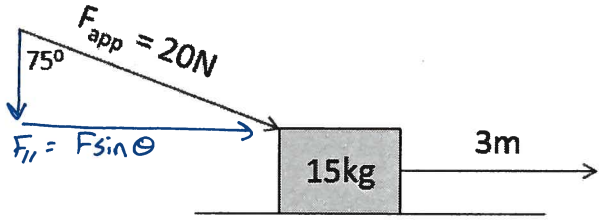



$W = |\vec{F}||\vec{d}|\cos\theta$
$= (200N)(6m)\cos 60$
$= 600\ J$
$= 6.00 \times 10^2\ J$

*Use the following information to answer Q7:*

**Force Acting on an Object**




**Q7:** The work done on the object is ***a.bc*** x 10$^d$ J, where ***a, b, c,*** and ***d*** are ___, ___, ___, and ___.

*(Record your **four-digit** answer in the Numerical Response boxes below)*

| | | | |
|---|---|---|---|
| 5 | 8 | 0 | 1 |

$W = F_{//}\, d$
$= (F\sin\theta)(d)$
$= (20\sin 75)(3)$
$= 57.9555\ J$
$\approx 5.79555 \times 10^1\ J$
$\approx 5.80 \times 10^1\ J$

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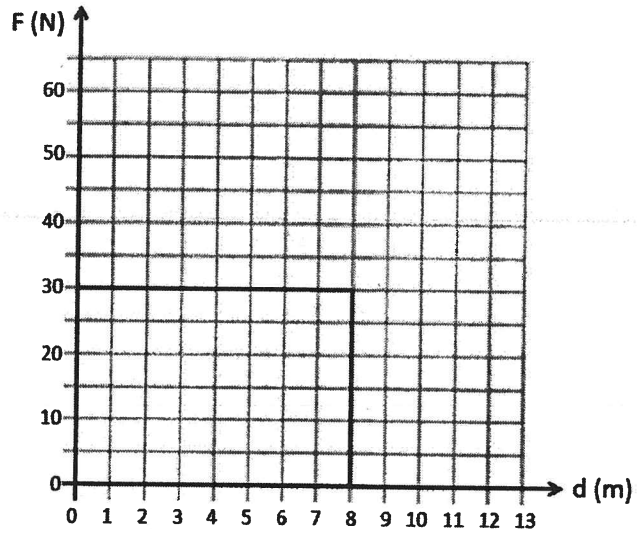
## Part 3: Graphical Interpretations of Work

*Use the following information to answer Q8-Q10:*

**Force-Distance graph depicting effort required to drag a box across a carpet.**




**Q8:** How much work was done in the first 3 meters?

a. 10J
b. 33J
(c.) 90J
d. 240J

$W = Fd$
$= (30)(3)$
$= 90\,J$

**Q9:** How much work was done in the first 8 meters?

$W = Fd$
$= (30)(8)$
$= 240\,J$

**Q10:** How much work was done in the first 10 meters?

*(Record your **three-digit** answer in the Numerical Response boxes below)*

| 2 | 4 | 0 | |
|---|---|---|---|

Note that the force is only applied for the first 8m.

W: Area under graph
$= (30)(8)$
$= 240\,J$

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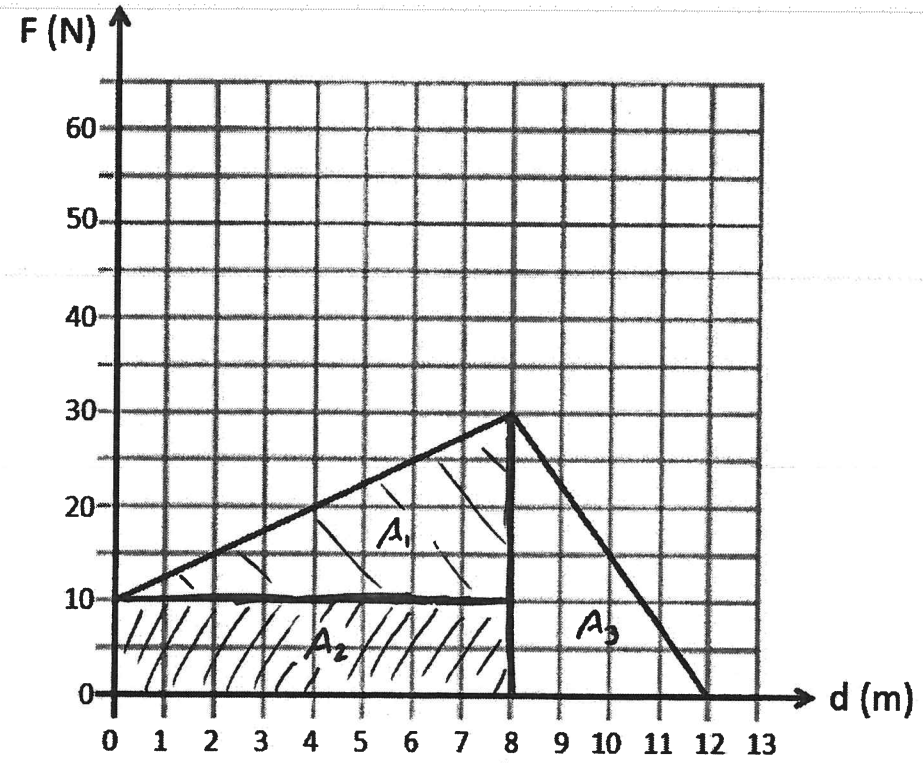
*Use the following information to answer Q11:*

**Force-Distance graph depicting effort required to drag a box across a carpet.**




**Q11:** How much work was done to drag the box 12 meters across the carpet?

Work: Area under graph

$A_1 = \frac{1}{2}bh = \frac{1}{2}(8)(20) = 80$

$A_2 = Lw = (8)(10) = 80$

$A_3 = \frac{1}{2}bh = \frac{1}{2}(4)(30) = 60$

Total work: total AREA $= (80 + 80 + 60)$

Work: 220 J

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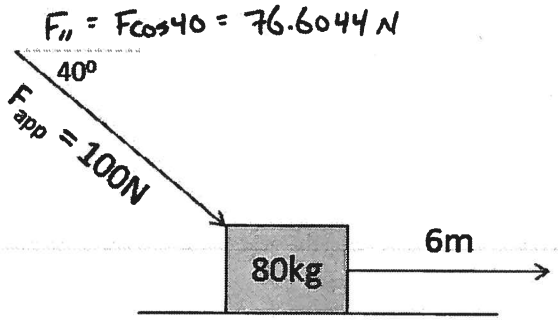
## Part 4: Work, Dynamics and Kinematics

*Use the following information to answer Q12-Q14:*

**Force Acting on an Initially Stationary Object**




**Q12:** The work done over 6m is ***a.bc*** x $10^{d}$ joules, where ***a, b, c,*** and ***d*** are ___, ___, ___, and ___.

*(Record your **four-digit** answer in the Numerical Response boxes below)*

| 4 | 6 | 0 | 2 |
|---|---|---|---|

$W = F_{\parallel} d$
$= (76.6044)(6)$
$= 459.6267\ J$
$\approx 4.60 \times 10^{2}\ J$

**Q13:** Assuming that the system is frictionless, the acceleration of the object is ____ $m/s^2$.

*(Record your **three-digit** answer in the Numerical Response boxes below)*

| 0 | . | 9 | 6 |
|---|---|---|---|

$a = \frac{F_{net}}{m} = \frac{76.6044\ N}{80kg} = 0.95756\ m/s^2$

$a \approx 0.96\ m/s^2$

**Q14:** At the end of the 6m push, the object is moving at a speed of ____ m/s.

*(Record your **three-digit** answer in the Numerical Response boxes below)*

| 3 | . | 3 | 9 |
|---|---|---|---|

$v_f^2 = v_i^2 + 2ad$
$v_f^2 = (0)^2 + 2(0.95756)(6)$
$v_f^2 = 11.49067$
$v_f = 3.38979\ m/s$
$v_f \approx 3.39\ m/s$